



MRT Technology (Suzhou) Co., Ltd  
Phone: +86-512-66308358  
Fax: +86-512-66308368  
Web: www.mrt-cert.com

Report No.: 1510RSU01102  
Report Version: V02  
Issue Date: 11-05-2015

## MEASUREMENT REPORT

### FCC PART 15.407 WLAN 802.11a/n/ac

**FCC ID:** 2ADU2-H50317

**APPLICANT:** Hiro Inc.

**Application Type:** Certification

**Product:** wifi adapter

**Model No.:** H50317, H50316, H50318

**Brand Name:** HiRO

**FCC Classification:** Unlicensed National Information Infrastructure (UNII)

**FCC Rule Part(s):** Part 15.407

**Test Procedure(s):** ANSI C63.10-2013, KDB 789033 D02v01,  
KDB 662911 D01v02r01, KDB 644545 D03v01  
KDB 662911 D02v01

**Test Date:** October 13 ~ 23, 2015

Reviewed By : Robin Wu  
( Robin Wu )

Approved By : Marlin Chen  
( Marlin Chen )



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033 D02v01. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

## Revision History

Report No.	Version	Description	Issue Date
1510RSU01101	Rev. 01	Initial report	10-30-2015
1510RSU01101	Rev. 02	Updated Equipment Description	11-05-2015

## CONTENTS

Description	Page
<b>§2.1033 General Information .....</b>	<b>5</b>
<b>1. INTRODUCTION .....</b>	<b>6</b>
1.1. Scope .....	6
1.2. MRT Test Location .....	6
<b>2. PRODUCT INFORMATION .....</b>	<b>7</b>
2.1. Equipment Description.....	7
2.2. Operation Frequency / Channel list.....	8
2.3. Test Mode .....	8
2.4. Test Software.....	8
2.5. Device Capabilities .....	9
2.6. Test Configuration .....	11
2.7. EMI Suppression Device(s)/Modifications.....	11
2.8. Labeling Requirements.....	11
<b>3. DESCRIPTION OF TEST .....</b>	<b>12</b>
3.1. Evaluation Procedure .....	12
3.2. AC Line Conducted Emissions .....	12
3.3. Radiated Emissions .....	13
<b>4. ANTENNA REQUIREMENTS.....</b>	<b>14</b>
<b>5. TEST EQUIPMENT CALIBRATION DATE .....</b>	<b>15</b>
<b>6. MEASUREMENT UNCERTAINTY.....</b>	<b>16</b>
<b>7. TEST RESULT .....</b>	<b>17</b>
7.1. Summary .....	17
7.2. 26dB Bandwidth Measurement.....	19
7.2.1. Test Limit .....	19
7.2.2. Test Procedure used.....	19
7.2.3. Test Setting.....	19
7.2.4. Test Setup .....	19
7.2.5. Test Result.....	20
7.3. 6dB Bandwidth Measurement.....	25
7.3.1. Test Limit .....	25
7.3.2. Test Procedure used.....	25
7.3.3. Test Setting.....	25

7.3.4. Test Setup .....	25
7.3.5. Test Result.....	26
7.4. Output Power Measurement .....	31
7.4.1. Test Limit .....	31
7.4.2. Test Procedure Used .....	31
7.4.3. Test Setting.....	31
7.4.4. Test Setup .....	31
7.4.5. Test Result.....	32
7.5. Power Spectral Density Measurement .....	33
7.5.1. Test Limit .....	33
7.5.2. Test Procedure Used .....	33
7.5.3. Test Setting.....	33
7.5.4. Test Setup .....	34
7.5.5. Test Result.....	35
7.6. Frequency Stability Measurement.....	42
7.6.1. Test Limit .....	42
7.6.2. Test Procedure Used .....	42
7.6.3. Test Setup .....	42
7.6.4. Test Result.....	43
7.7. Radiated Spurious Emission Measurement .....	44
7.7.1. Test Limit .....	44
7.7.2. Test Procedure Used .....	44
7.7.3. Test Setting.....	44
7.7.4. Test Setup .....	45
7.7.5. Test Result.....	47
7.8. Radiated Restricted Band Edge Measurement .....	67
7.8.1. Test Limit .....	67
7.8.2. Test Result of Radiated Restricted Band Edge .....	69
7.9. AC Conducted Emissions Measurement.....	113
7.9.1. Test Limit .....	113
7.9.2. Test Procedure .....	113
7.9.3. Test Setup .....	114
7.9.4. Test Result.....	115
<b>8. CONCLUSION.....</b>	<b>117</b>

## §2.1033 General Information

<b>Applicant:</b>	Hiro Inc.
<b>Applicant Address:</b>	13617 12th St. Unit C, Chino, CA 91710
<b>Manufacturer:</b>	Hiro Inc.
<b>Manufacturer Address:</b>	13617 12th St. Unit C, Chino, CA 91710
<b>Test Site:</b>	MRT Technology (Suzhou) Co., Ltd
<b>Test Site Address:</b>	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
<b>MRT FCC Registration No.:</b>	809388
<b>FCC Rule Part(s):</b>	Part 15.407
<b>Model No.:</b>	H50317, H50316, H50318
<b>FCC ID:</b>	2ADU2-H50317
<b>Test Device Serial No.:</b>	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
<b>FCC Classification:</b>	Unlicensed National Information Infrastructure (UNII)

### Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.



## 1. INTRODUCTION

### 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

### 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

Product Name	wifi adapter
Model No.	H50317, H50316, H50318
Brand Name	HiRO
Frequency Range	For 802.11a/n-HT20/ac-VHT20: 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5755~5795MHz For 802.11ac-VHT80: 5775MHz
Maximum Average Output Power	802.11a: 10.49dBm 802.11n-HT20: 9.56dBm 802.11n-HT40: 9.19dBm 802.11ac-VHT20: 5.01dBm 802.11ac-VHT40: 3.11dBm 802.11ac-VHT80: 2.15dBm
Type of Modulation	802.11a/n/ac: OFDM
Antenna Type	Dipole Antenna
Antenna Gain	2dBi
Directional Gain	5.01dBi

Note 1: For other features of this EUT, test report will be issued separately.

Note 2: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

For CDD transmissions, directional gain is calculated as follows,  $N_{ANT} = 2$ ,  $N_{SS} = 1$ .

If all antennas have the same gain,  $G_{ANT}$ , Directional gain =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain =  $10 \log (N_{ANT}/ N_{SS})$  dB = 3.01;

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB for  $N_{ANT} \leq 4$ ;

Directional gain =  $G_{ANT} + \text{Array Gain}$ .

## 2.2. Operation Frequency / Channel list

802.11a/n-HT20/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
149	5745 MHz	153	5765 MHz	157	5785 MHz
161	5805 MHz	165	5825 MHz	--	--

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz	--	--

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
155	5775 MHz	--	--	--	--

## 2.3. Test Mode

Test Mode	Mode 1: Transmit by 802.11a
	Mode 2: Transmit by 802.11n-HT20
	Mode 3: Transmit by 802.11n-HT40
	Mode 4: Transmit by 802.11ac-VHT20
	Mode 5: Transmit by 802.11ac-VHT40
	Mode 6: Transmit by 802.11ac-VHT80

## 2.4. Test Software

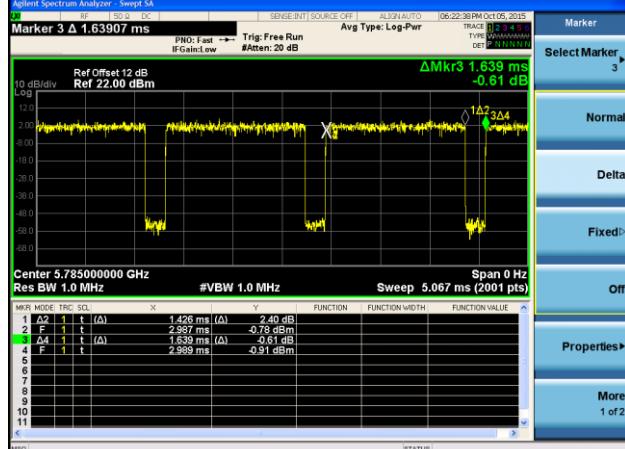
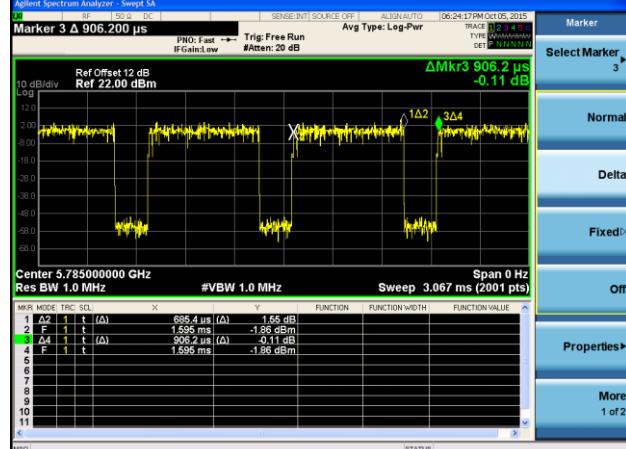
The test utility software used during testing was “MT7662UQA.exe”.

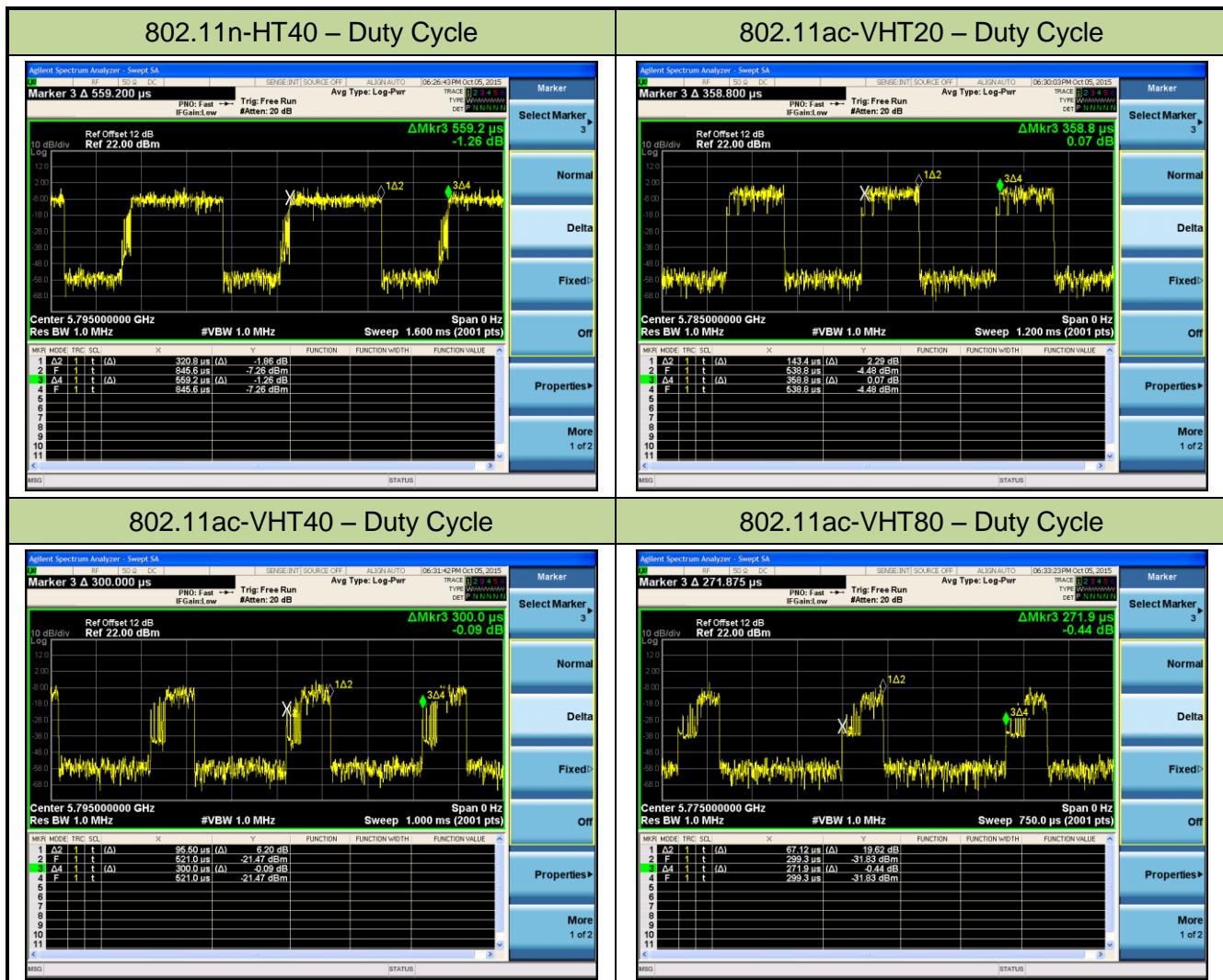
## 2.5. Device Capabilities

This device contains the following capabilities:

2.4GHz WLAN (DTS) and 5GHz WLAN (UNII).

**Note:** 5GHz (NII) operation is possible in 20MHz, 40MHz and 80MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
802.11a	87.0%
802.11n-HT20	75.6%
802.11n-HT40	57.4%
802.11ac-VHT20	40.0%
802.11ac-VHT40	31.8%
802.11ac-VHT80	24.7%
802.11a – Duty Cycle	802.11n-HT20 – Duty Cycle
	



## **2.6. Test Configuration**

The **wifi adapter FCC ID: 2ADU2-H50317** was tested per the guidance of KDB 789033 D02v01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

## **2.7. EMI Suppression Device(s)/Modifications**

No EMI suppression device(s) were added and/or no modifications were made during testing.

## **2.8. Labeling Requirements**

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

### 3. DESCRIPTION OF TEST

#### 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 789033 D02v01 were used in the measurement of the **wifi adapter FCC ID: 2ADU2-H50317**.

**Deviation from measurement procedure.....None**

#### 3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

Line conducted emissions test results are shown in Section 7.9.

### 3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

## 4. ANTENNA REQUIREMENTS

### **Excerpt from §15.203 of the FCC Rules/Regulations:**

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of **wifi adapter** uses a unique connector.

### **Conclusion:**

The **wifi adapter FCC ID: 2ADU2-H50317** unit complies with the requirement of §15.203.

## 5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2015/11/07
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06114	1 year	2015/11/20

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MRTSUE06028	1 year	2015/12/09
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Preamplifier	Agilent	83017A	MRTSUE06020	1 year	2015/12/13
Preamplifier	Schwarzbeck	BBV9721	MRTSUE06121	1 year	2016/04/15
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2015/11/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2015/11/08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2015/11/08
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2016/01/05
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06115	1 year	2015/11/20

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2016/04/23
USB Wideband Power Sensor	Boonton	55006	MRTSUE06109	1 year	2015/10/15
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06112	1 year	2015/11/20

Software	Version	Function
e3	V8.3.5	EMI Test Software

## 6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2U_{C(y)}$ ): 150kHz~30MHz: 3.46dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2U_{C(y)}$ ): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 40GHz: 4.76dB

## 7. TEST RESULT

### 7.1. Summary

**Company Name:** Hiro Inc.  
**FCC ID:** 2ADU2-H50317  
**FCC Classification:** Unlicensed National Information Infrastructure (UNII)  
**Data Rate(s) Tested:** 6Mbps ~ 54Mbps (a);  
13/14.4Mbps ~ 130/144.4Mbps (n-HT20MHz BW);  
27/30Mbps ~ 270/300Mbps (n-HT40MHz BW);  
13/14.4Mbps ~ 156/173.4Mbps (ac-VHT20MHz BW);  
27/30Mbps ~ 360/400Mbps (ac-VHT40MHz BW);  
58.6/65Mbps ~ 780/866.6Mbps (ac-VHT80MHz BW)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407(a)	26dB Bandwidth	N/A	Conducted	Pass	Section 7.2
15.407(e)	6dB Bandwidth	≥ 500kHz		Pass	Section 7.3
15.407(a)(3)	Maximum Conducted Output Power	≤ 30 dBm U-NII-3		Pass	Section 7.4
15.407(a)(3), (5)	Peak Power Spectral Density	≤ 30 dBm/500kHz U-NII-3		Pass	Section 7.5
15.407(g)	Frequency Stability	N/A		Pass	Section 7.6
15.407(b)(4)	Undesirable Emissions	≤ -27dBm/MHz EIRP ≤ -17dBm/MHz EIRP	Radiated	Pass	Section 7.7 & 7.8
15.205, 15.209 15.407(b)(5), (6), (7)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		Pass	
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.9

Notes:

- 1) All channels, modes, and modulations/data rates were investigated among all UNII bands. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
- 4) Test Items “26dB Bandwidth” & “6dB Bandwidth” have been assessed the MIMO transmission, and showed the worst chain test data in this report.

## 7.2. 26dB Bandwidth Measurement

### 7.2.1. Test Limit

N/A

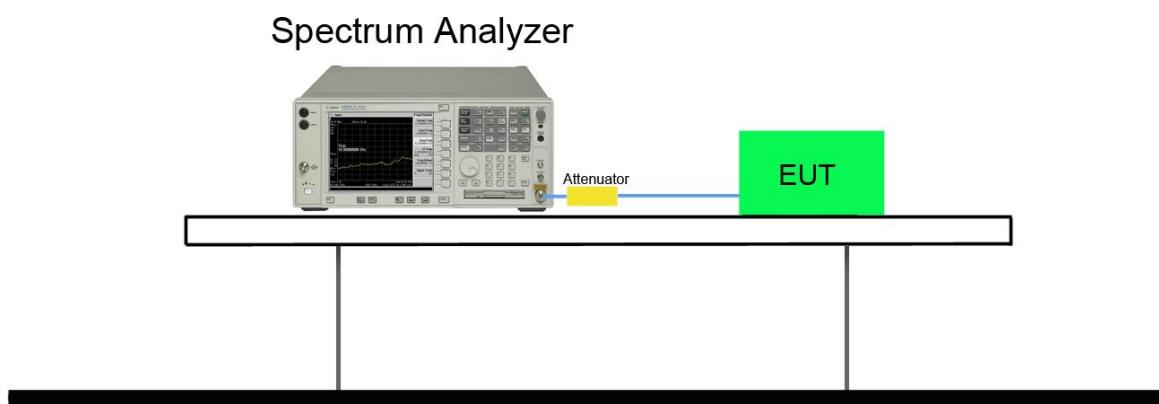
### 7.2.2. Test Procedure used

KDB 789033 D02v01 – Section C.1

### 7.2.3. Test Setting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW  $\geq 3 \times$  RBW.
4. Detector = Peak.
5. Trace mode = max hold.

### 7.2.4. Test Setup



### 7.2.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
Ant 1 / Ant 0 + 1						
802.11a	6	149	5745	19.17	16.53	Pass
802.11a	6	157	5785	19.30	16.46	Pass
802.11a	6	165	5825	19.50	16.49	Pass
802.11n-HT20	13	149	5745	19.82	17.58	Pass
802.11n-HT20	13	157	5785	19.39	17.62	Pass
802.11n-HT20	13	165	5825	19.81	17.59	Pass
802.11n-HT40	27	151	5755	39.83	36.04	Pass
802.11n-HT40	27	159	5795	39.66	36.10	Pass
802.11ac-VHT20	13	149	5745	19.44	17.46	Pass
802.11ac-VHT20	13	157	5785	19.10	17.40	Pass
802.11ac-VHT20	13	165	5825	19.23	17.44	Pass
802.11ac-VHT40	27	151	5755	39.97	36.04	Pass
802.11ac-VHT40	27	159	5795	39.70	36.08	Pass
802.11ac-VHT80	58.6	155	5775	80.04	74.69	Pass

### 802.11a 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 0 + 1

#### Channel 149 (5745MHz)



#### Channel 157 (5785MHz)



#### Channel 165 (5825MHz)



### 802.11n-HT20 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 0 + 1

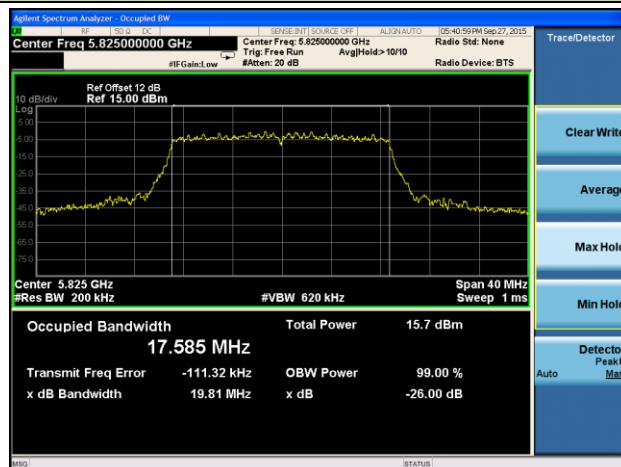
#### Channel 149 (5745MHz)



#### Channel 157 (5785MHz)



#### Channel 165 (5825MHz)

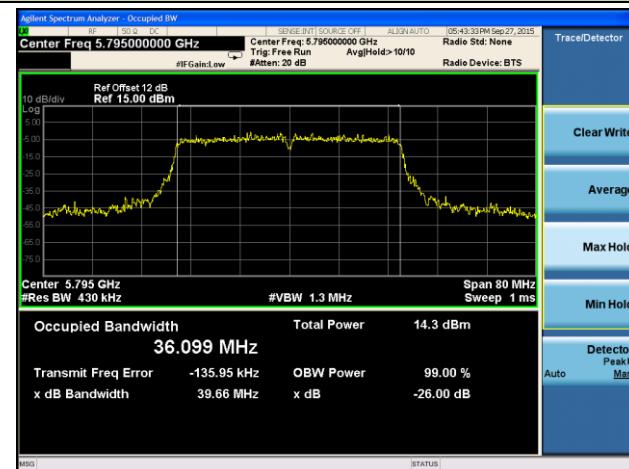


### 802.11n-HT40 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 0 + 1

#### Channel 151 (5755MHz)

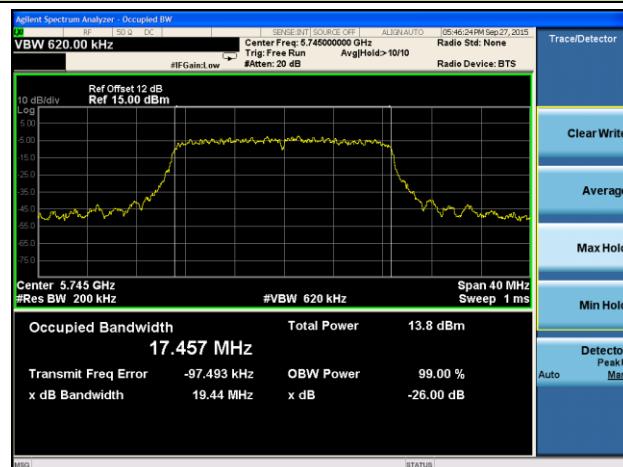


#### Channel 159 (5795MHz)

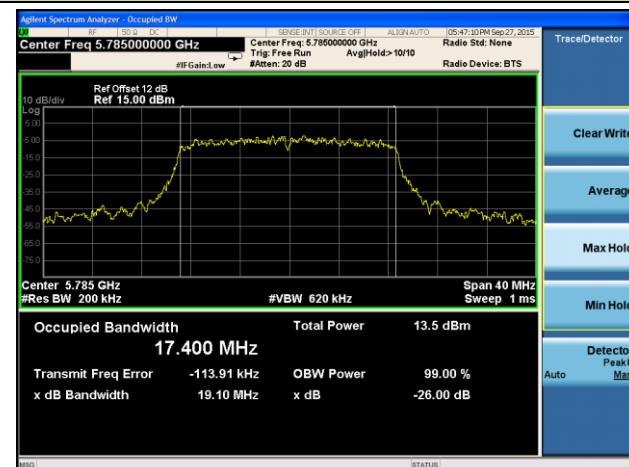


### 802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 0 + 1

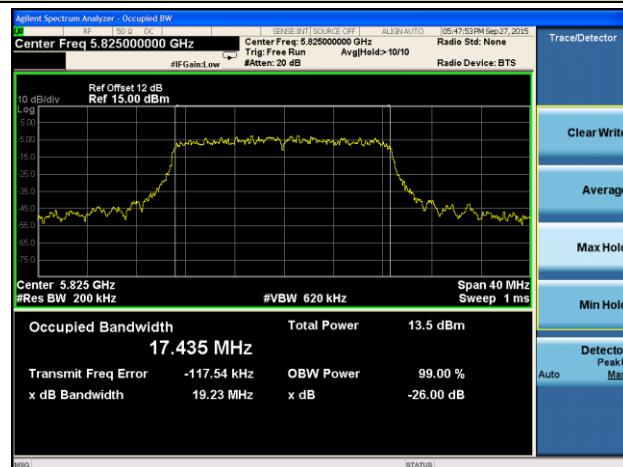
#### Channel 149 (5745MHz)



#### Channel 157 (5785MHz)



#### Channel 165 (5825MHz)



### 802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 0 + 1

Channel 151 (5755MHz)



Channel 159 (5795MHz)



### 802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 0 + 1

Channel 155 (5775MHz)



### 7.3. 6dB Bandwidth Measurement

#### 7.3.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

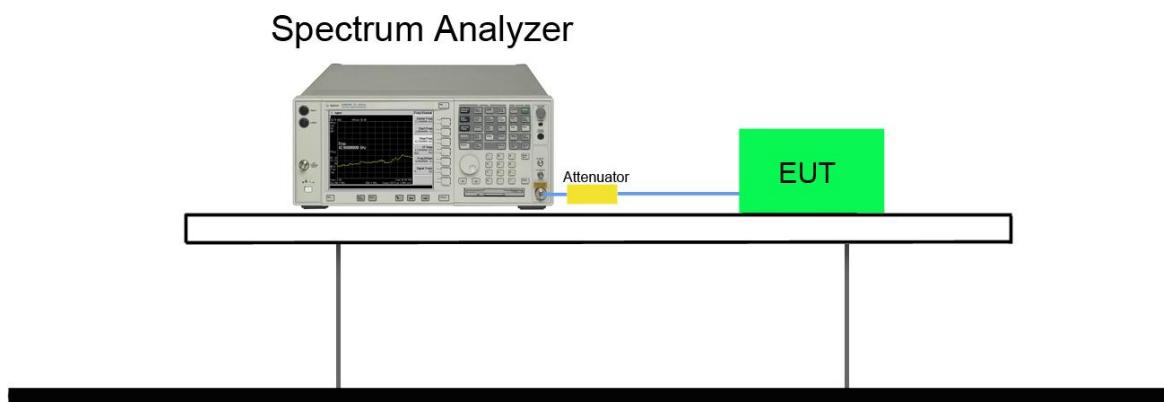
#### 7.3.2. Test Procedure used

KDB 789033 D02v01 – Section C.2

#### 7.3.3. Test Setting

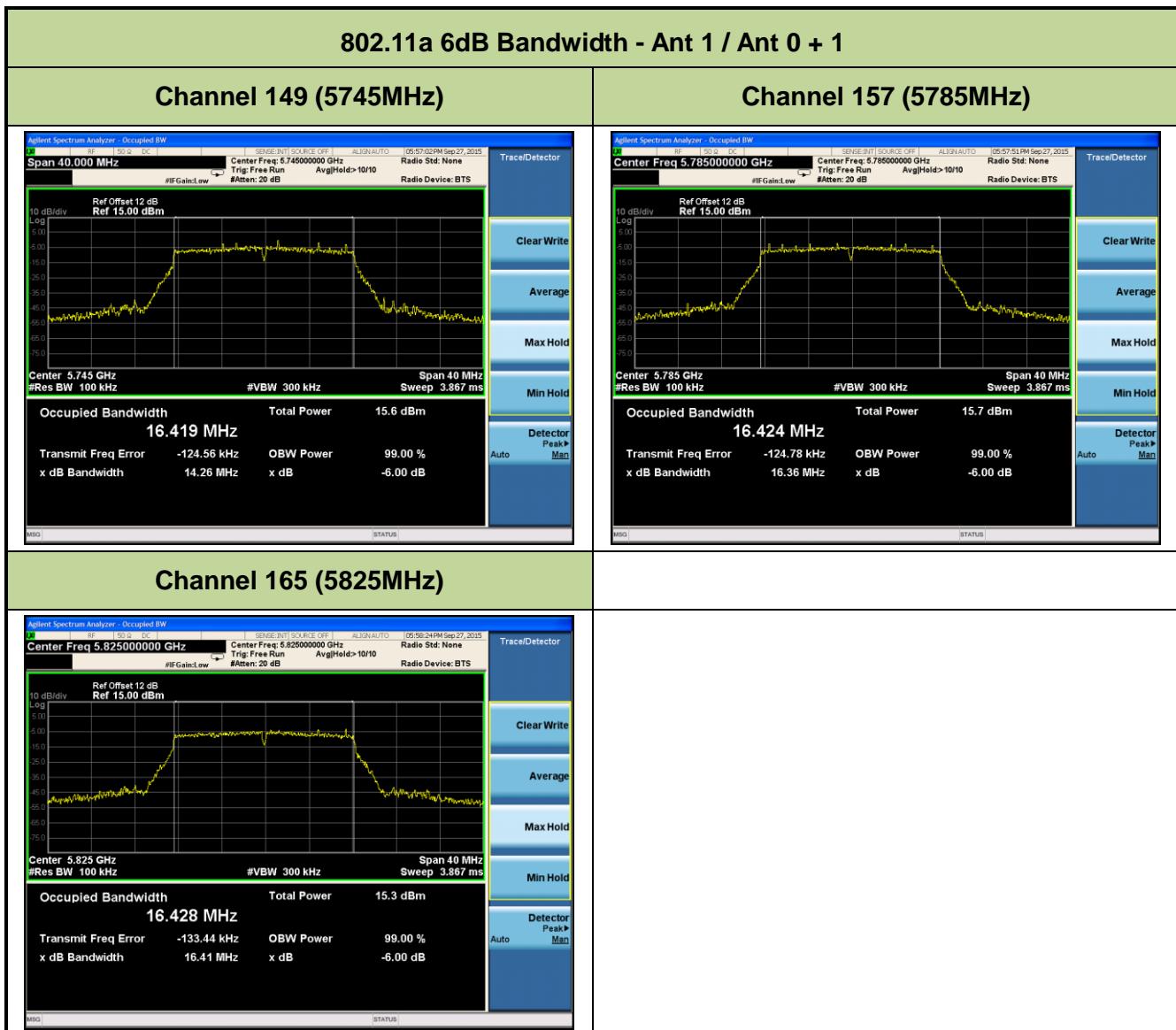
1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 100 kHz.
3. VBW  $\geq$  3 x RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

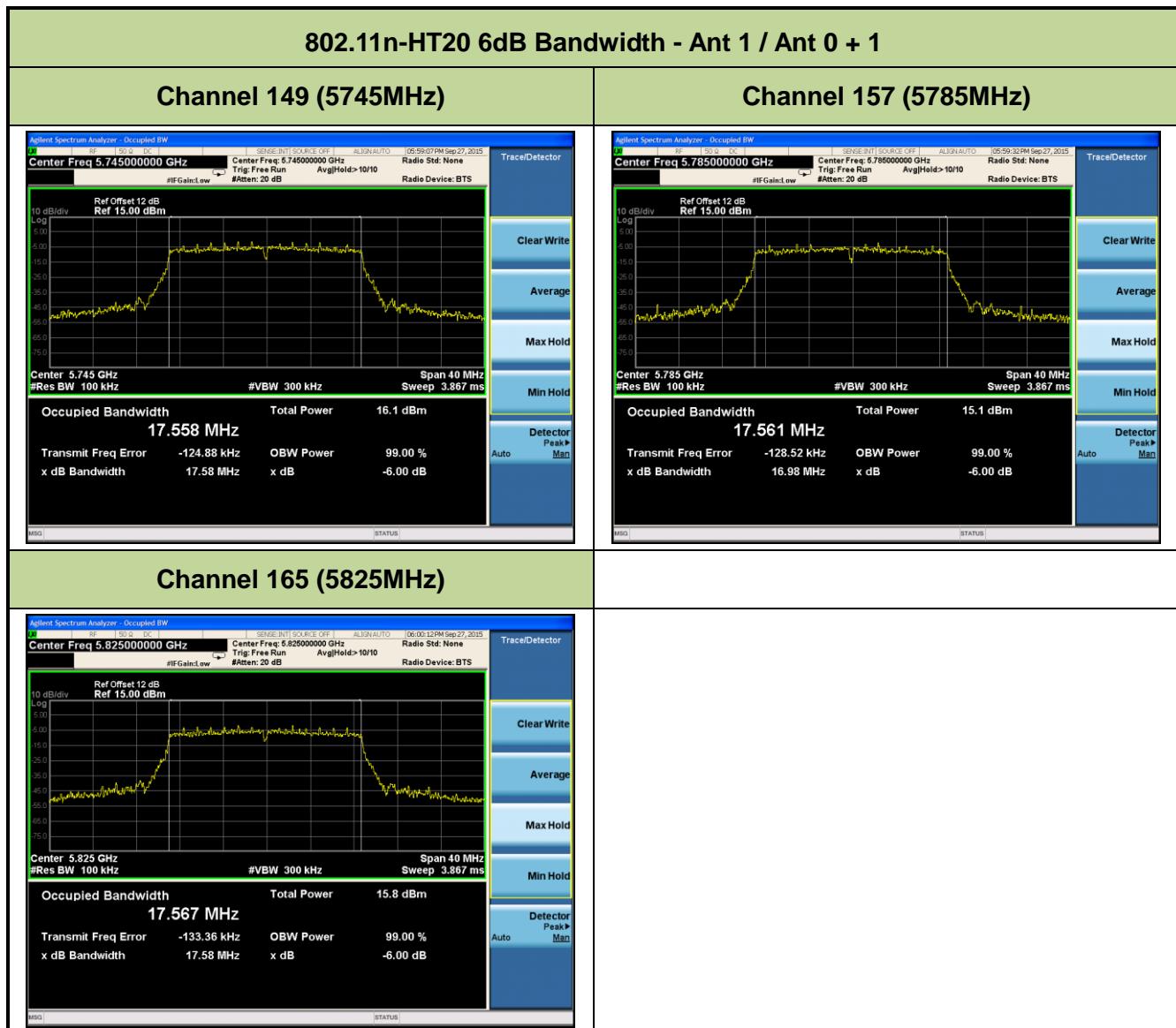
#### 7.3.4. Test Setup



### 7.3.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 1 / Ant 0 + 1						
802.11a	6	149	5745	14.26	≥ 0.5	Pass
802.11a	6	157	5785	16.36	≥ 0.5	Pass
802.11a	6	165	5825	16.41	≥ 0.5	Pass
802.11n-HT20	13	149	5745	17.58	≥ 0.5	Pass
802.11n-HT20	13	157	5785	16.98	≥ 0.5	Pass
802.11n-HT20	13	165	5825	17.58	≥ 0.5	Pass
802.11n-HT40	27	151	5755	33.94	≥ 0.5	Pass
802.11n-HT40	27	159	5795	35.15	≥ 0.5	Pass
802.11ac-VHT20	13	149	5745	15.18	≥ 0.5	Pass
802.11ac-VHT20	13	157	5785	16.36	≥ 0.5	Pass
802.11ac-VHT20	13	165	5825	15.75	≥ 0.5	Pass
802.11ac-VHT40	27	151	5755	35.19	≥ 0.5	Pass
802.11ac-VHT40	27	159	5795	34.80	≥ 0.5	Pass
802.11ac-VHT80	58.6	155	5775	75.24	≥ 0.5	Pass



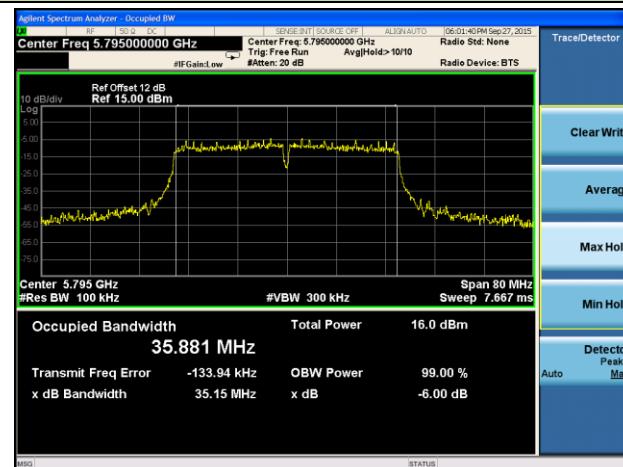


#### **802.11n-HT40 6dB Bandwidth - Ant 1 / Ant 0 + 1**

**Channel 151 (5755MHz)**

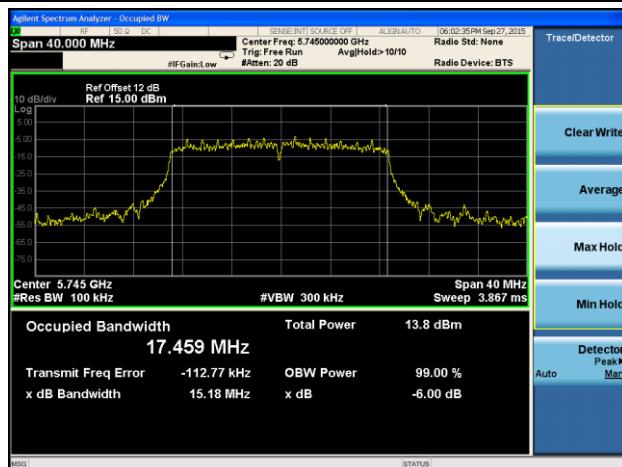


**Channel 159 (5795MHz)**

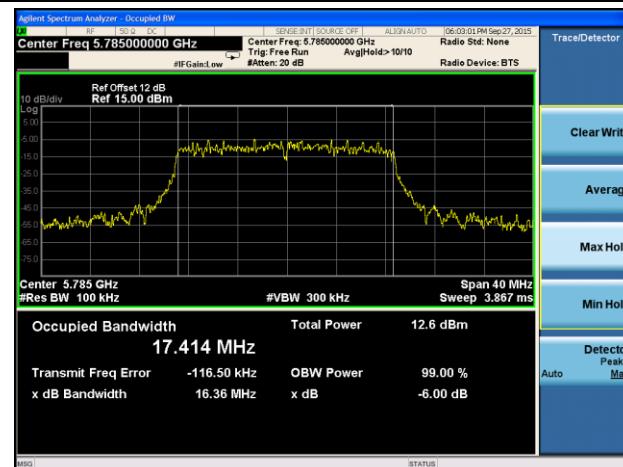


#### **802.11ac-VHT20 6dB Bandwidth - Ant 1 / Ant 0 + 1**

**Channel 149 (5745MHz)**



**Channel 157 (5785MHz)**

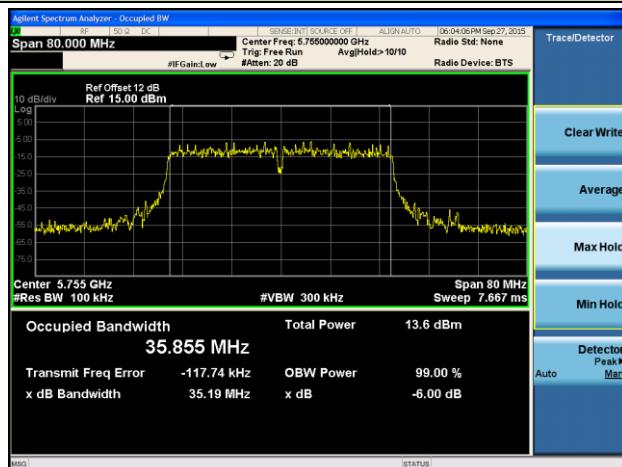


## Channel 165 (5825MHz)

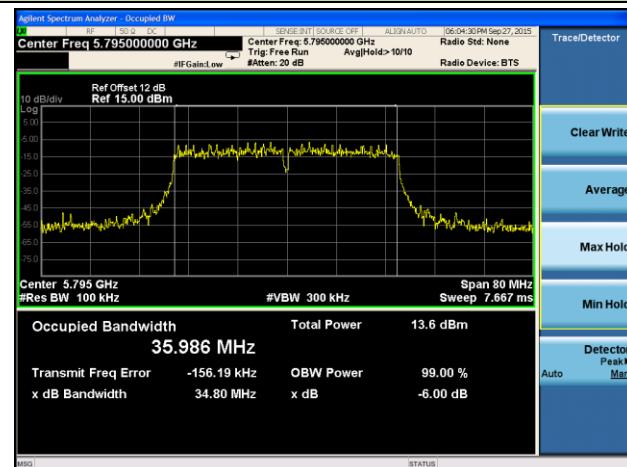


### 802.11ac-VHT40 6dB Bandwidth - Ant 1 / Ant 0 + 1

#### Channel 151 (5755MHz)

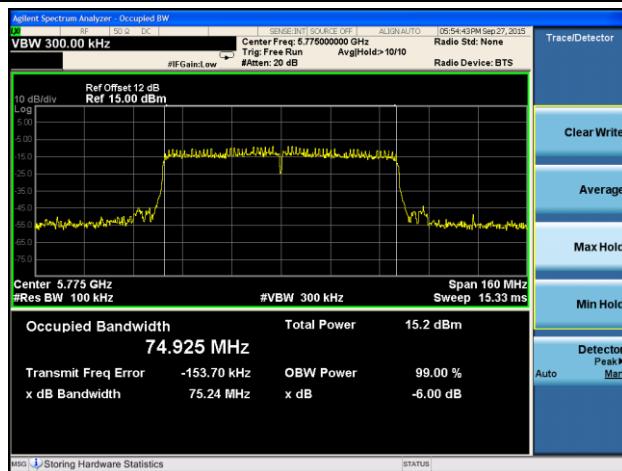


#### Channel 159 (5795MHz)



### 802.11ac-VHT80 6dB Bandwidth - Ant 1 / Ant 0 + 1

#### Channel 155 (5775MHz)



## 7.4. Output Power Measurement

### 7.4.1. Test Limit

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

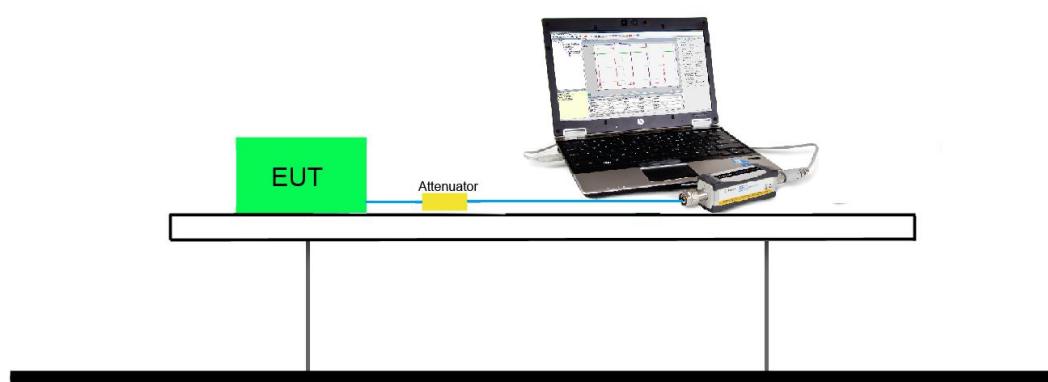
### 7.4.2. Test Procedure Used

KDB 789033 D02v01 - Section E) 3) b) Method PM-G

### 7.4.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

### 7.4.4. Test Setup



#### 7.4.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
11a	6	149	5745	5.68	8.63	10.41	≤ 30	Pass
11a	6	157	5785	5.51	8.72	10.42	≤ 30	Pass
11a	6	165	5825	5.82	8.67	10.49	≤ 30	Pass
11n-HT20	13	149	5745	5.02	6.89	9.07	≤ 30	Pass
11n-HT20	13	157	5785	5.78	7.21	9.56	≤ 30	Pass
11n-HT20	13	165	5825	5.38	7.28	9.44	≤ 30	Pass
11n-HT40	27	151	5755	4.67	6.24	8.54	≤ 30	Pass
11n-HT40	27	159	5795	4.56	7.35	9.19	≤ 30	Pass
11ac-VHT20	13	149	5745	-0.68	2.28	4.06	≤ 30	Pass
11ac-VHT20	13	157	5785	0.07	3.33	5.01	≤ 30	Pass
11ac-VHT20	13	165	5825	-0.41	2.69	4.42	≤ 30	Pass
11ac-VHT40	27	151	5755	-2.44	1.69	3.11	≤ 30	Pass
11ac-VHT40	27	159	5795	-1.58	0.92	2.86	≤ 30	Pass
11ac-VHT80	58.6	155	5775	-2.59	0.38	2.15	≤ 30	Pass

Note: The Total Average Power (dBm) =  $10^{\text{Ant 0 Average Power /10}} + 10^{\text{Ant 1 Average Power /10}}$ .

## 7.5. Power Spectral Density Measurement

### 7.5.1. Test Limit

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

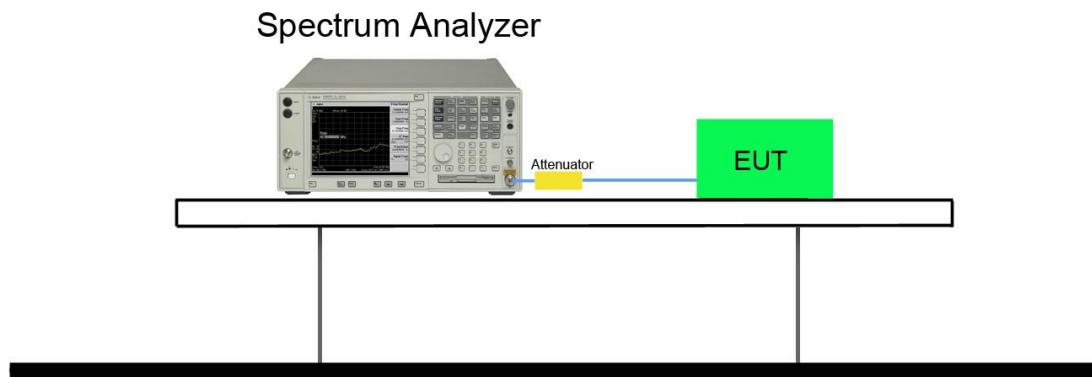
### 7.5.2. Test Procedure Used

KDB 789033 D02v01 - Section F

### 7.5.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz,  
RBW = 100 kHz
4. VBW = 3MHz
5. Number of sweep points  $\geq 2 \times (\text{span} / \text{RBW})$
6. Detector = power averaging (RMS)
7. Sweep time = auto
8. Trigger = free run
9. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
10. Add  $10 \log(1/x)$ , where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add  $10 \log(1/0.25) = 6$  dB if the duty cycle is 25 percent.
11. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor  $10 \log(500\text{kHz}/100\text{kHz}) = 7$  dB to the measured result

#### 7.5.4. Test Setup



### 7.5.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 PSD (dBm/500kHz)	Ant 1 PSD (dBm/500kHz)	Duty Cycle (%)	Constant Factor	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Result
11a	6	149	5745	-11.98	-5.28	87.0	7	3.17	≤ 30	Pass
11a	6	157	5785	-13.41	-5.85	87.0	7	2.46	≤ 30	Pass
11a	6	165	5825	-13.16	-5.95	87.0	7	2.41	≤ 30	Pass
11n-HT20	13	149	5745	-13.80	-6.58	75.6	7	2.39	≤ 30	Pass
11n-HT20	13	157	5785	-13.77	-7.04	75.6	7	2.01	≤ 30	Pass
11n-HT20	13	165	5825	-13.28	-6.34	75.6	7	2.68	≤ 30	Pass
11n-HT40	27	151	5755	-17.51	-9.98	57.4	7	0.14	≤ 30	Pass
11n-HT40	27	159	5795	-17.70	-10.36	57.4	7	-0.21	≤ 30	Pass
11ac-VHT20	13	149	5745	-16.80	-14.99	40.0	7	-1.81	≤ 30	Pass
11ac-VHT20	13	157	5785	-18.02	-15.27	40.0	7	-2.44	≤ 30	Pass
11ac-VHT20	13	165	5825	-17.23	-14.03	40.0	7	-1.35	≤ 30	Pass
11ac-VHT40	27	151	5755	-21.93	-17.20	31.8	7	-3.97	≤ 30	Pass
11ac-VHT40	27	159	5795	-21.57	-18.05	31.8	7	-4.47	≤ 30	Pass
11ac-VHT80	58.6	155	5775	-24.34	-22.30	24.7	7	-7.11	≤ 30	Pass

Note: When EUT duty cycle < 98%, the Total PSD =  $10 \times \log\{10^{(\text{Ant 0 PSD}/10)} + 10^{(\text{Ant 1 PSD}/10)}\} + 10 \times \log(1/\text{duty cycle}) + \text{Constant Factor}$ .

